Canarygrass Control in Wheat

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Introduction

Weed problems in all crops reflect the characteristics of the weeds and the technology available to control them. Weeds are rarely completely eliminated but constantly changing in response to these conditions. Broadleaf weeds in grain crops and the herbicides used to control them have changed little over the past several years. Numerous broadleaf weeds are a problem and controlled with growth regulators (2,4-D, MCPA, dicamba and clopyralid), contact herbicides (bromoxynil, carfentrazone) or sulfonylureas (chlorsulfuron, metsulfuron, thifensulfruon). Grass weeds and the herbicides available to control them have, on the other hand, changed significantly in recent years. This report will concentrate upon grass weeds and recent herbicide developments.

Grass Weed in Grain

Wild oat (Avena fatua) was the major grass weed in grain throughout California and Arizona for many years. This weed is very competitive and yield reductions as high as 50% have been documented when even moderate infestations occur. Wild oat is sensitive to many of the available herbicides and it has been replaced over the years by grasses that are more difficult to control. Wild oat has been replaced in many regions by littleseed (Phalaris minor) and hood canarygrass (Phalaris paradoxa) and to a lesser extent by rabbitfootgrass (Polyprogon sp), wild barley (Hordeum sp), brome (Bromus sp.) and ryegrass (Lolium sp.) Canarygrass has become the predominant of these grasses and this report will concentrate upon these.

Canarygrass

Canarygrass (Phalaris spp.) has become the predominate weed in grain fields in many regions of California and Arizona. There are seven species of this weed which occur throughout the region, two of which cause major agricultural problems. Reed Canarygrass (P. caroliniana),short-spike Canarygrass (P. brachystachys), Common Canarygrass (P. canariensis), Carolina Canarygrass (P. caroliniana) and Harding grass (P. aquatica) normally are found in riverbeds, wildlife refuges, recreational areas and urban landscapes. They occasionally are found in agricultural fields. Littleseed Canarygrass (P. minor) and Hood Canarygrass (P. paradoxa) are major agricultural pests.

Littleseed and Hood canarygrass are prolific and competitive weeds. More than 125 seedlings per square foot are sometimes found in fields that have had wheat grown in them year after year. Yield reduction of greater than 50% have been documented as a result of heavy infestations. Littleseed canarygrass typically begins to germinate in October in the low deserts and continues to germinate until spring. It emerges from both shallow depths (top 1/2 inch) with the crop seed and much deeper (1-5 inches) where soils crack. It is common for canarygrass to be at variable growth stages, from 1 leaf to tillering, at the same time within a grain crop. These characteristics have contributed to the difficulty in controlling this weed with herbicides.

The first case of widespread herbicide resistance in the low desert has involved the resistance of Littleseed canarygrass to ACCase inhibitors in the Imperial Valley, California. This

was documented in 2002 and 2003 by Joe DiTomaso and Guy Kyser at the University of California, Davis. They found that the rate required to produce adequate control (90%) in the resistant population was 88 pt/A with sethoxydim, 69 pts. with fenoxaprop and 8 pts with fluazifop. Some resistance to clethodim was also found although the rate needed to produce adequate control was 0.25 pt./A of Prisim/select which is still practicable (unpublished data). Resistance of P. minor to ACCase inhibitors was previously reported in Israel (1993) and Mexico (1996). Although all of the herbicides that are commonly used to control canarygrass in grain in the Imperial Valley are ACCase inhibitors, problems have largely been encountered in onions and alfalfa, not in grain.

Control – Herbicides

The grass weed problems in grain reflect the herbicides available to control them. Diagram 1 illustrates the herbicides that have historically been available for grass control in grain from 1970 to present. Four grass herbicides have been registered within the last six years while only three were available during the previous thirty years. Additionally, the four registered within the last six years are more effective and safer to the crop. A brief discussion of each follows.

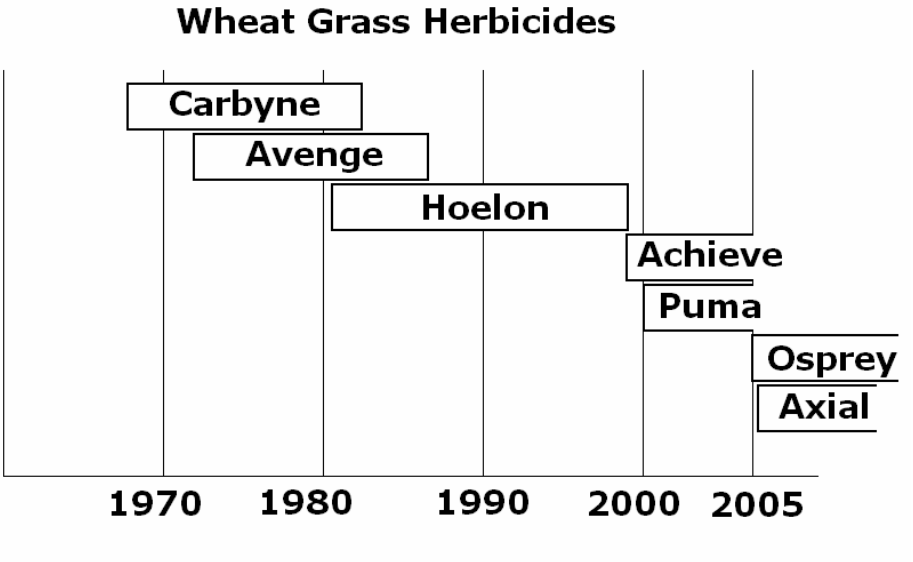


Diagram 1

Carbyne(barban) Discovered in the 1960's carbine was the principal herbicide used for the control of wild oat and canarygrass until the early 1980's when it was no longer available. Carbyne was better in controlling canarygrass than wild oat. Timing was critical as it would only control canarygrass to the 2 leaf stage of growth. Spray volume was also important and it was recommended that the volume be less than 10gpa. When the crop was under stress from cold, drought and other factors, yield reducing injury could occur. Tank mixes with broadleaf herbicides could occasionally cause reduction in weed control and crop injury.

Avenge (difenzoquat) registered in 1975 by American Cyanamide as a wild oat herbicide. It was effective on wild oat but weak on some other winter annual grasses including canarygrass. The use of this product was limited by the crop injury it caused to durum and some red wheat varieties. It has been replaced by other wild oat herbicides.

Hoeon (diclofop) registered in 1980 as one of the first ACCase inhibitors used for selective grass control in grain. This was one of the only herbicides available for annual grass control in grain between 1980 and 1999. It was very good on wild oats and only partially effective on canarygrass. Because of this, canarygrass became an increasingly problem and wild oat populations declined during this 20 year period. Partial control was related to the importance of the growth stage at the time of application of most annual grasses. Weeds at the 1 to 3 leaf stage were controlled while those at later growth stages or subsequent flushes were uncontrolled. Hoelon controls wild oat at growth stages up to 4 leaves. Applications could be delayed until all of these weeds had emerged with excellent results.

Achieve (tralkoxydim) available in 1999, Achieve was the first new grain herbicide registered in almost 20 years that was highly effective on several annual grasses. Achieve is an ACCase inhibitor that will control canarygrass, wild oat and other annual grasses up to the 5 leaf stage of growth. The multiple emergences of canarygrass can be controlled by waiting until they have all emerged and the crop is not too advanced to limit coverage. The use of Hoelon dropped off significantly when this herbicide was registered.

Puma (fenoxaprop) registered in 2000, one year after Achieve, this herbicide is similar in timing of application, weed control and crop safety to Achieve. It has been slightly more consistent than Achieve in our trials. Not registered in Arizona due to the requirement for additional environmental data. Puma will control most annual grasses including canarygrass, up to the 5 leaf stage and is effective on weeds that continually emerge and are at various growth stages at the time of application.

Osprey (mesosulfuron) registered in 2004, Osprey is a sulfonylurea. This different mode of action helps avoid the ACCase resistance that is spreading in canarygrass and some other annual grasses. Osprey has been highly effective in controlling wild oat and canarygrass in our trials and will also control some broadleaf weeds such as wild mustard, pigweed and wild radish. It can be applied at growth stages of up to 2 tillers for canarygrass. This overcomes the problem of multiple emergences of this weed. Crop safety is lower than with the ACCase inhibitors but has not resulted in reduced yields. The rotational crop restriction of 10 months to all crops except cotton (90 days), beans (90 days) and some other crops will limit the use of this herbicide in many diversified agricultural areas in the southwest. A recropping study was conducted in 2004/2005 to determine if 10 months was needed to avoid injury to rotational crops. In this study a 1 X rate (4.75 oz per acre) and 2 X rate (9.5 oz per acre) were applied to a fallow field and planted to 8 crops at 2, 4 and 8 month intervals. Dry weights and plant population were measured. At two months the only significant reduction which occurred was in the weight of broccoli at the 2 X rate. No other reductions were measured at the 2, 4 or 8 month intervals. The crops that were planted were alfalfa, lettuce, sugarbeets, spinach, cantaloupe, cotton, onions and broccoli. The 4 month planting was made in July when only the warm weather crops, cotton, melons, sugarbeets and alfalfa would grow. This study indicated that a 10 month plantback interval was unneeded and the herbicide is gone after a normal grain growing season. (Appendix 1)

Axial (pinoxaden) Just registered in December 2005, penoxaden is a little different from the other group I ACCase inhibitors. It is in a new class called phenylpyrazolin herbicides. The mode of action is the same as that of aryloxyphenody propionate (FOP) and cyclohexanedione (DIM) herbicides but this new class will be termed DENS. This herbicide may be active on some of the group I resistant biotypes including littleseed canarygrass. The 2004/05 season was the first time we had this in a trial and it was very effective on canarygrass. It can be applied up to the tillering stage of the weeds and will control multiple flushes of canarygrass. Crop injury was

a problem in durum wheat especially when mixed with some broadleaf herbicides, and it is not currently registered for use in durum.

Tank Mix Combinations

Growers frequently like to mix grass herbicides with broadleaf herbicides for convenience, cost savings and to avoid driving over the field an additional time. Osprey and Axial both control some broadleaf weeds. The best time for application for both grass and broadleaf weeds often does not coincide and the spectrum of weeds controlled with Osprey and Axial is not as large as it is with many of the broadleaf herbicides available. For these reasons, broadleaf weed control with Osprey and Axial is an added benefit but often not a substitute for broadleaf herbicides.

Tank mix combinations of grass and broadleaf herbicides often causes either increased crop injury or reduced weed control. Grass weed control can be reduced when mixing Puma and Achieve with many of the broadleaf herbicides while crop injury can result when doing the same with Osprey and Axial. Often it is the adjuvant used with the tank mix partner rather than the active ingredient that causes the problem.

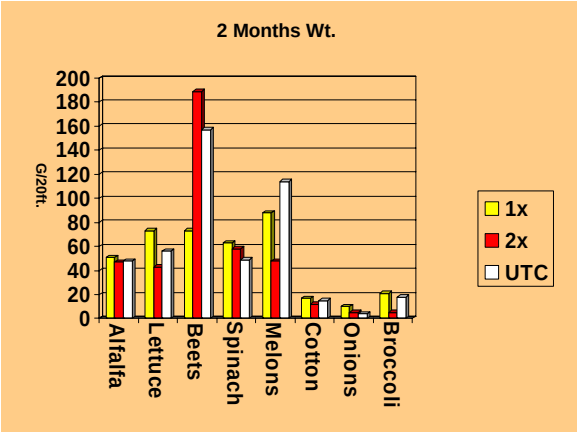
Table 1 – Results of tests to evaluate 7 herbicides for the control of Littleseed Canarygrass in spring wheat and durum.

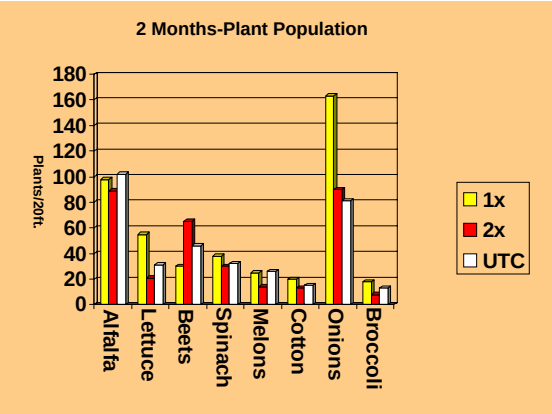
Herbicide	# of tests	Canarygrass Control			Phototoxicity		
		High	Low	Ave.	High	Low	Ave.
Carbyne	8	95	70	85	40	0	10
Avenge	6	40	0	25	85	0	65
Hoelon	13	95	50	70	10	0	4
Achieve	9	96	75	85	10	0	2
Puma	7	99	83	89	10	0	2
Osprey	7	99	90	95	22	0	13
Axial	2	99	95	98	30	5	12

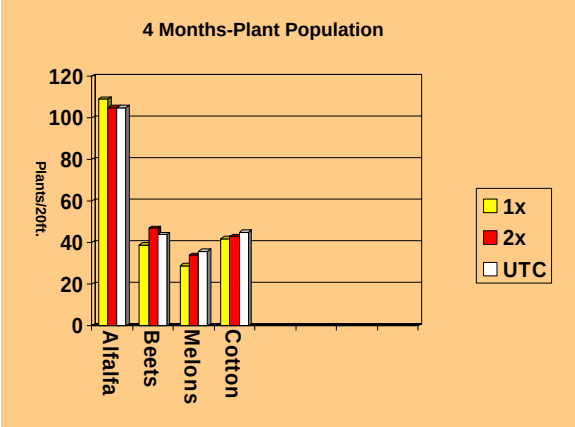
Acknowledgment

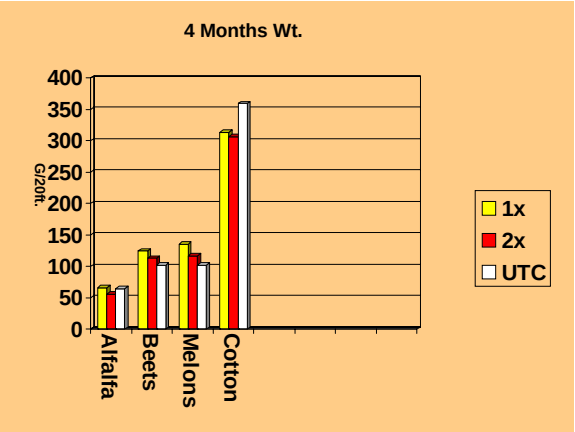
This project was supported by the Arizona Grain Research and Promotion Council

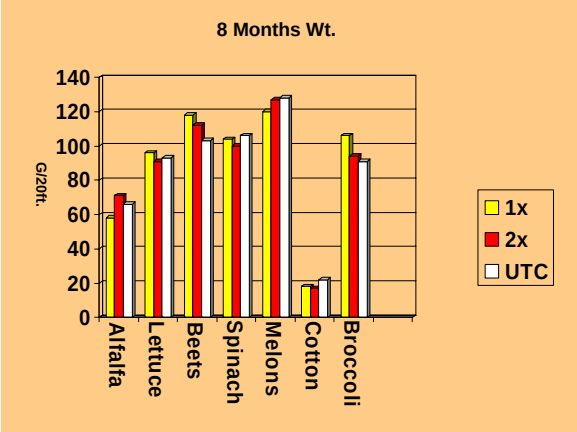
Appendix 1.

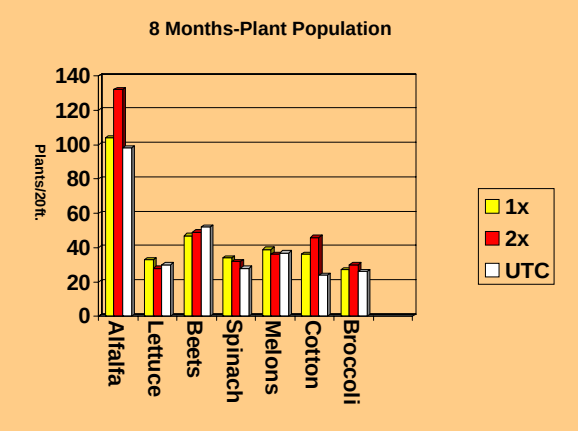

2 Months Wt.
G/20ft.
200
180
160
140
120
100
80
60
40
20
0
Alfalfa
Lettuce
Beets
Spinach
Melons
Cotton
Onions
Broccoli
1x
2x
UTC


2 Months-Plant Population
Plants/20ft.
180
160
140
120
100
80
60
40
20
0
Alfalfa
Lettuce
Beets
Spinach
Melons
Cotton
Onions
Broccoli
1x
2x
UTC


4 Months-Plant Population
Plants/20ft.
120
100
80
60
40
20
0
Alfalfa
Beets
Melons
Cotton
1x
2x
UTC


4 Months Wt.
G/20ft.
400
350
300
250
200
150
100
50
0
Alfalfa
Beets
Melons
Cotton
1x
2x
UTC


8 Months Wt.
G/20ft.
140
120
100
80
60
40
20
0
Alfalfa
Lettuce
Beets
Spinach
Melons
Cotton
Broccoli
1x
2x
UTC


8 Months-Plant Population
Plants/20ft.
140
120
100
80
60
40
20
0
Alfalfa
Lettuce
Beets
Spinach
Melons
Cotton
Broccoli
1x
2x
UTC

Appendix 2. 2006 Trial Results

Herbicide	Rate (OZ./AC)	Phytotoxicity (% Visual)*	Control (% Visual)*
Axial & Adigor	**8.2 + 9.6**	**8.3 b**	**98.3 a**
Osprey & MSO	**4.75 + 24**	**21.6 a**	**95 a**
Achieve L & Supercharge	**9.6 + 0.5%**	**3.3 c**	**85 b**
Puma	**10.6**	**1.6 c**	**78.3 c**
Untreated	**----------**	**0 c**	**0 d**

LSD (0.05) = 4.697 LSD (0.05) = 6.643

* Average of 3 replications

Notes: Location: Tacna, AZ
Soil: Silty Loam
Applied: 1-26-06
Evaluated: Control: 5-24-06
Phyto : 2-15-06 (22 DAT)
Weeds: Littleseed Canarygrass (5-30/ft.^{2})